JUN 19 1944

JOURNAL OF

THE INSTITUTE OF PETROLEUM

FOUNDED 1913 INCORPORATED 1914

Vol. 30 APRIL 1944 No. 244

CONTENTS

	PAGE
Orientated Hand Coring in Geological Field Work. By K. Rohr	79
Inauguration of New Premises	90
Obituary: J. McConnell Sanders	94
Abstracts	151A
Books Received	182A
Institute Notes	i–iii

Published by the Institute of Petroleum.
Address: "Manson House," 26, Portland Place, London, W.1.
Telephone No.: LANgham 2250.
Printed in Great Britain by Richard Clay and Company, Ltd., Bungay, Suffolk.

All rights of Publication or Translation are Reserved.

Price 7s. 6d.

THE INSTITUTE OF PETROLEUM

COUNCIL

PRESIDENT :

F. H. Garner, O.B.E., Ph.D., F.R.I.C., M.I.A.E., M.I.Chem.E.

PAST-PRESIDENTS :

Alfred C. Adams
Lt.-Col. S. J. M. Auld, O.B.E., M.C., D.Sc.
Prof. J. S. S. Brame, C.B.E., F.R.I.C.
T. Dewhurst, A.R.C.S.
A. E. Dunstan, D.Sc., F.R.I.C.
Sir Thomas H. Holland, K.C.S.I., K.C.I.E., D.Sc., F.R.S.
J. Kewley, M.A., F.R.I.C.

VICE-PRESIDENTS :

Ashley Carter, A.M.I.Mech.E.
G. H. Coxon
A. C. Hartley, O.B.E., F.C.G.I.
V. C. Illing, M.A.
J. S. Jackson, B.Sc., F.R.I.C.
J. A. Oriel, M.C., M.A.

MEMBERS OF COUNCIL :

R. Crichton, J.P.
A. Frank Dabell, M.I.Mech.E.
E. A. Evans, M.I.A.E.
E. B. Evans, Ph.D., M.Sc., F.R.I.C.
W. E. Gooday, A.R.S.M., D.I.C.
E. R. Redgrove, Ph.D., B.Sc.
C. A. P. Southwell, M.C., B.Sc.
H. C. Tett, B.Sc., D.I.C.
F. B. Thole, D.Sc., F.R.I.C.
A. Beeby Thompson, O.B.E.
A. Wade, D.Sc., A.R.C.S.
W. J. Wilson, F.R.I.C., A.C.G.I.
C. W. Wood, F.R.I.C.

Arthur W. Eastlake, A.M.I.Mech.E.
Ashley Carter, A.M.I.Mech.E.
} Joint Honorary Secretaries

HONORARY EDITOR : Dr. A. E. Dunstan
HONORARY ASSOCIATE EDITOR : Prof. F. H. Garner, O.B.E.
HONORARY TREASURER : The Rt. Hon. Lord Plender, G.B.E.
SECRETARY : F. H. Coe

EDITORIAL ADVISORY BOARD :

A. E. Dunstan (Chairman)
F. H. Garner
Ashley Carter
Gustav Egloff (U.S.A.)
V. C. Illing
J. A. Oriel
C. A. P. Southwell

Vol. 30. No. 244. April 1944.

ORIENTATED HAND CORING IN GEOLOGICAL FIELD WORK.

By K. Rohr.*

Introduction.

Success in exploration geology largely depends on the practicability of methods and means of obtaining adequate geological data in the field. Increased demands for more detailed mapping and elucidation of structural details require improvement in exploration technique. It is hoped that the method of orientated coring herein described will contribute towards this end.

Historical Notes.

As far as surface exploration methods in Trinidad are concerned, a *résumé* of their history is of some interest.

Wall and Sawkins [1] carried out the first geological exploration of the island in the classical manner of making use of natural exposures only. About forty years later Cunningham Craig [2] investigated the oil districts of Trinidad on behalf of the Government. The results of his mapping have formed the basis of all subsequent exploration surveys for oil.

Cunningham Craig made use of natural outcrops only, though even in those days geologists engaged in oil exploration of the Dutch East Indian rain forests resorted to hand-dug pits wherever natural outcrops were lacking.

So far as is known, it was not until 1912 that *hand-dug pits* were resorted to in Trinidad. (F. Zyndel of Trinidad Leaseholds, Ltd., for detailed mapping of the Forest structure of South Trinidad.)

During the survey of the Naparima district, which is almost devoid of natural exposures, V. C. Illing [3] was confronted with the interpretation of complex geology. In this connection he wrote :

> " It soon became apparent that no half measures would be satisfactory, and that the area would have to be examined in detail with numerous pits and trenches. In the course of the work over 9000 pits and about 100 trenches were examined. The pits were usually 8 feet deep, this depth being quite satisfactory for structural evidence, provided that the pit was so located as to avoid positions of deep subsoil or of soil-creep. In areas of complicated structure it was found that trenches gave more valuable evidence than pits; such trenches were usually 18 to 27 feet long and 8 feet deep, but occasionally much longer.
>
> Every pit and trench was thoroughly sampled and searched for fossils. Foraminiferal washings obtained from the material were hand-

* Geologist, Trinidad Leaseholds, Limited, Trinidad, B.W.I.

picked, and form the basis of the associated paper contributed by Dr. W. L. F. Nuttall. In addition, all the sandy and silty material was treated for heavy mineral analysis, the records of such analyses being found to be valuable for local comparisons."

Others followed the lead set by Zyndel and Illing, with the result that geological mapping with the aid of pits constituted an essential part of field work.

Contrary to the procedure described by O. P. Jenkins [4] in Sumatra, test-pit lines should always be carefully located by the geologist himself and not by a native chainman. Pit-lines must be located on stable ground, preferably on the crest of ridges and on spurs, thus avoiding landslips, hill creeps and alluvial flats.

The *hand-auger method*, as a further means of obtaining well-preserved and uncontaminated samples for micro-palæontological, petrographical and geochemical analyses from otherwise inaccessible sediments, was introduced in Trinidad in 1920 by V. C. Illing and H. G. Kugler. Illing [3] stated:

"While the pitting was in progress, a soil-map was constructed, the boundaries of the various types of soils giving valuable evidence of the trend of the formation below. The soil-map, carefully interpreted, was a necessary adjunct to the pit-map in determining the geological boundaries; but in all the important areas these were proved by lines of auger-holes along and across them.

"In certain areas of difficult structure, the evidence of pits and even of trenches was found to be somewhat indefinite. In such cases, a series of deeper auger-holes from 27 to 65 feet were placed across the structure at distances apart varying according to the detail required. In areas of thick alluvium, the work was done completely with augers, and broad areas under 35 feet of alluvium were dealt with in detail. I found that such methods were infinitely to be preferred to core-drills for soft rocks, and even in the case of harder beds, such as gravels in the alluvium, the hole could be continued with a chisel-bit. In one area in the south it was found that the cheapest, quickest, and most effective method of examination was to discard pitting altogether, and to grid the area with auger-holes down to a recognizable horizon. The auger-holes were carefully surveyed and levelled, and a stratum contour-map produced of this particular horizon."

In 1939 E. C. Scott [5] further analysed the merits of pitting and augering in conjunction with shallow core-drilling. He illustrated the various auger types ranging from 4-inch post-hole augers to the most commonly used 1½-inch carpenter's auger. The latter is generally screwed on to 10 or 20-feet joints of 1-inch standard line pipe or, preferably, steam pipe. They are rotated by the use of 18-inch or 24-inch Stilson wrenches. Another method is to weld the carpenter's auger on to a 5-foot joint of ¾-inch pipe, a hollow "T" joint being screwed on to the other end: the pipe is then rotated by means of an iron bar placed through the "T" joint. On having drilled the length of the bit and the additional 5 feet of pipe, the "T" is removed and another 5 feet length of pipe added. The "T" is then screwed to the top of this additional joint and drilling resumed.

Below a depth of 40 feet simple hand operation becomes uneconomical, so that one has to resort to a drilling mast or tripod and snatch-block, by which means depths considerably over 100 feet have been reached in non-caving clays. To go deeper than 100 feet is not recommended because of the danger of twisting off.

The main disadvantage of sampling by means of carpenter's augers is that the samples obtained can be used only for chemical and microscopical studies. In formations without a marker bed, the three-point method of determining the dip is not applicable, and pitting or orientated core-drilling is the only alternative. The introduction of an easily transportable, economic type of coring equipment has, therefore, been one of the strong desires of exploration geologists. The author has designed such a tool for orientated hand-coring; and this was introduced in November 1941. It has proved to be very satisfactory for conditions in Trinidad.

Description of Orientated Coring Device.

The device and accessories are illustrated in Figs. 1–7. The equipment as described is for use with augering tools, in which the auger bit is $1\frac{3}{4}$ inches in diameter, and is run on $\frac{3}{4}$-inch pipe. The orientated coring device proper, as sketched in Fig. 1, consists of three main parts :

1. The *outer string* of $\frac{3}{4}$-inch standard line pipe (A) of length equivalent to depth of auger hole plus about 1 foot. (This can be the same string of pipe as is used for ordinary augering.) When the string is made up for core-taking, the top of it protrudes approximately 3 feet above the ground, a height convenient for orientation and coring operations as described below.

2. The *inner string* consisting of an upper round iron road (*B*) of 4–6 feet length of $\frac{5}{8}$-inch diameter to be used as driving hammer, and a lower rod (*C*) of approximately $\frac{1}{2}$-inch diameter and a length equivalent to casing minus 2 feet. A buffer (D) of 1-inch length by $\frac{11}{16}$-inch diameter is inserted between drive rod and core assembly to prevent deformation of core-barrel head.

3. *Core-barrel assembly*. The core barrel assembly embraces three pieces :

(i) A $\frac{3}{4}$-inch slotted steel guide tube (*E*) of about 7 inches length, joined by an ordinary collar (*F*) to the bottom of the $\frac{3}{4}$-inch outer string; (ii) the core-barrel head (*G*), consisting of a piece of turned steel having a sliding fit in the guide tube. A key (H) near the top of the core-barrel head engages in the slots (I) of the guide tube to prevent relative rotation; (iii) the core-barrel proper (*J*), which is screwed on the lower part of the core-barrel head. It is best made of steel, bored to 1-inch inside diameter and 7-inch length, thus yielding a core of a maximum length of 6 inches and 1 inch diameter. The cutting edge (*M*) is formed by bevelling the outside edge as shown in the sketch. Near the bottom end of the core barrel a steel scriber (*K*) inserted in line with the orientation marks on the outer string (L), produces an orienting groove as the core enters the core-barrel. The three parts of the core-barrel assembly are detailed in Figs. 2, 3, and 4.

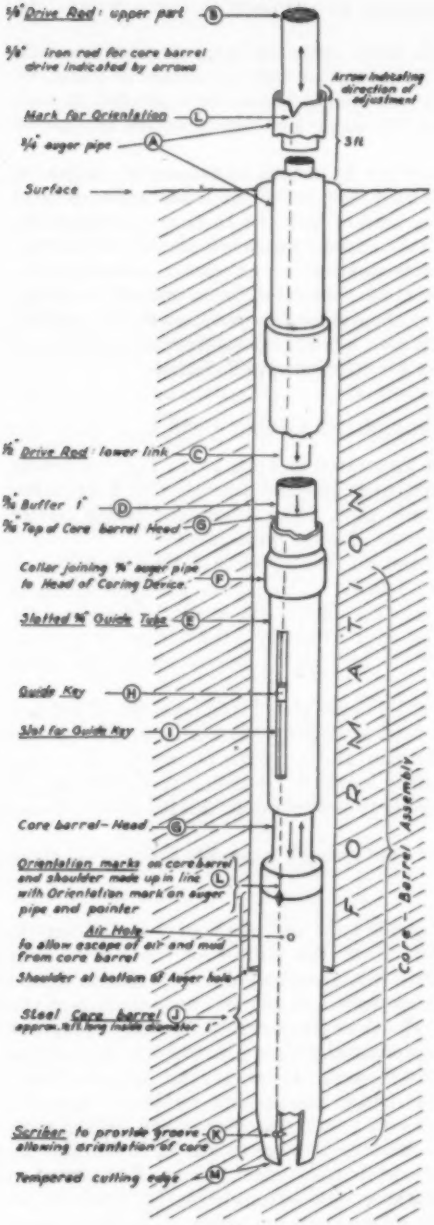

⅝" Drive Rod: upper part (B)
⅜" iron rod for core barrel drive indicated by arrows
Arrow indicating direction of adjustment
Mark for Orientation (L)
¾" auger pipe (A)
3 ft
Surface
1⅛" Drive Rod: lower link (C)
⅞" Buffer 1" (D)
⅞" Top of Core barrel Head (G)
Collar joining ¾" auger pipe to Head of Coring Device. (F)
Slotted ¾" Guide Tube (E)
Guide Key (H)
Slot for Guide Key (I)
Core barrel-Head (G)
Orientation marks on core barrel and shoulder made up in line (L) with Orientation mark on auger pipe and pointer
Air Hole to allow escape of air and mud from core barrel
Shoulder at bottom of Auger hole
Steel Core barrel (J) approx. 4ft long inside diameter 1"
Scriber to provide groove allowing orientation of core (K)
Tempered cutting edge (M)
Core Barrel Assembly

FIG. 1.

SKETCH SHOWING COMPLETE DEVICE FOR ORIENTATED CORING.
(Not drawn to scale.)

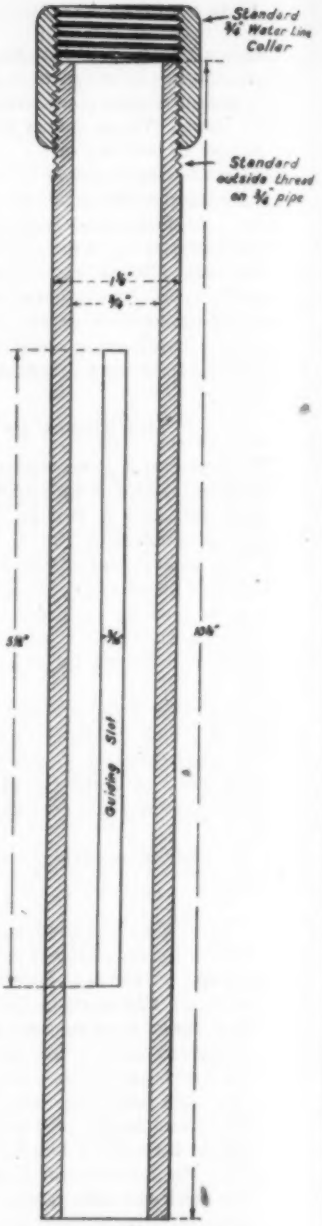


FIG. 2.

¾" SLOTTED GUIDE TUBE (SECTION) WITH STANDARD WATER LINE COLLAR.

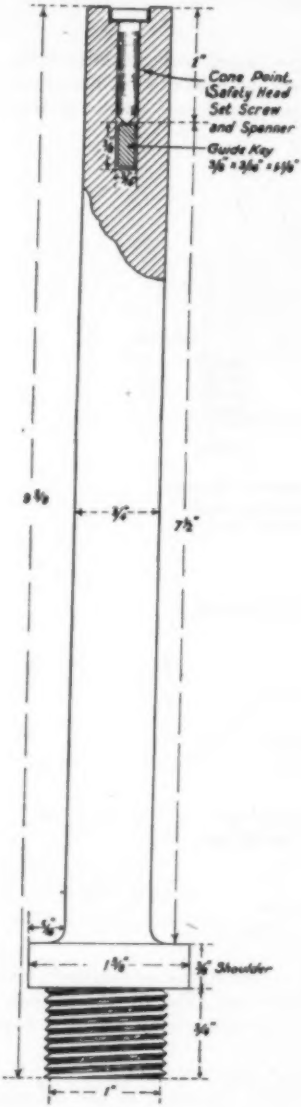


FIG. 3.
CORE BARREL HEAD.
(Made from Solid Steel.)

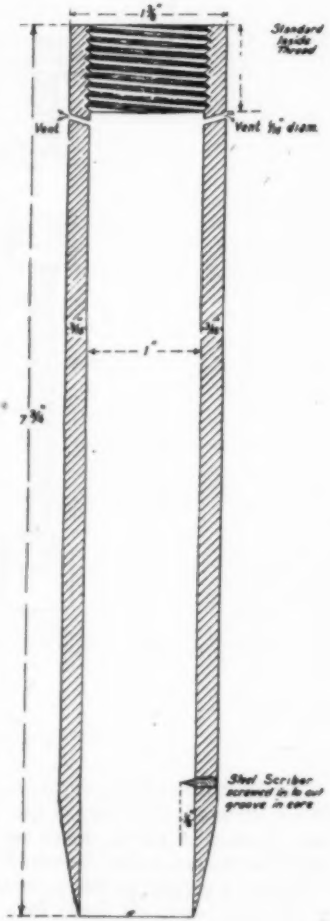


FIG. 4.
CORE BARREL.

Accessories.

A. Core Extractor.

As a rule, the core is held firmly in the core-barrel, and cannot be removed by hand, thus necessitating the use of a mechanical device, illustrated in Fig. 5; this device is a modification of the usual core extractor used in oilfields.

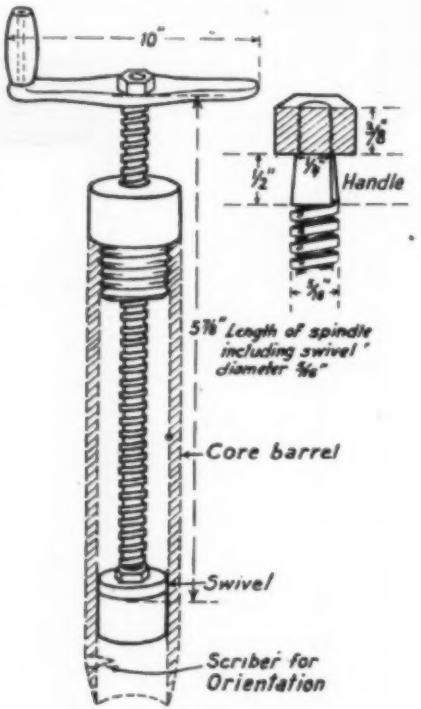


FIG. 5.

CORE EXTRACTOR.

(Not drawn to scale.)

The illustration being self-explanatory, a description is omitted. Attention is directed, however, to the swivelling head (Fig. 6), the smooth and easy rotation of which, under any degree of stress, is an essential requirement for obtaining non-deformed cores.

Failing a proper swivel, or if the swivel does not rotate freely, torsion effect expresses itself firstly in a progressive deviation of the orientation groove in the upper portion of the core, due to rotation of the core in the barrel, and secondly in actual twisting of the substance of upper portion of the core. It will be appreciated that these effects are in opposed directions, but would usually be confined to the upper part of the core. Consequently,

only the lower part of the core should be used for orientation purposes (see Fig. 8).

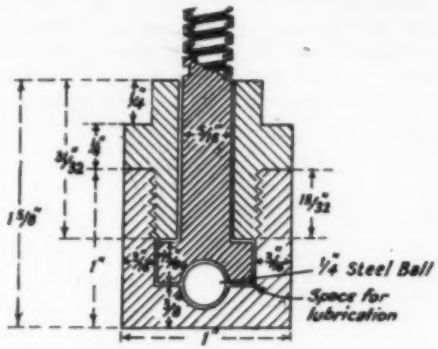


FIG. 6.
CORE EXTRACTOR SWIVEL (SECTION.)

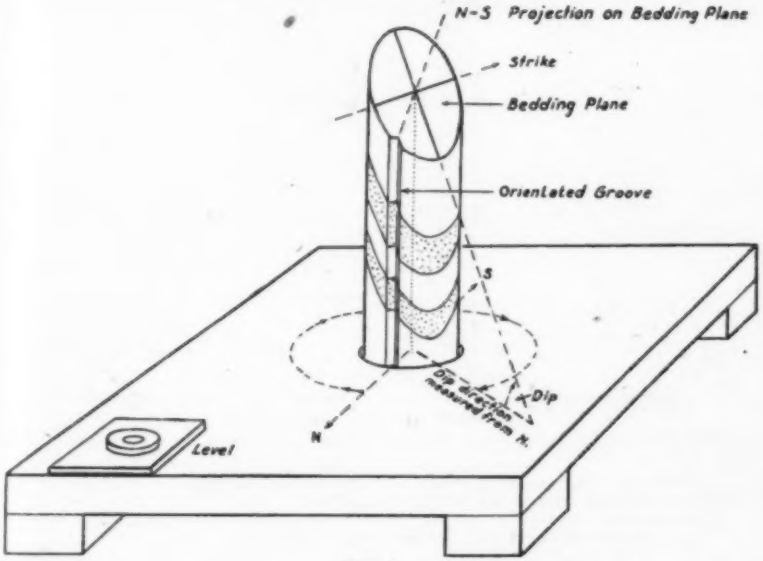


FIG. 7.
(Not drawn to scale.)

B. Table Suitable for Core Orientation of Prepared Core in the Field.

This consists of a simple 4-inch by 4-inch board of 1-inch thickness. A 1-inch hole bored in the centre keeps the core in vertical position, provided that the table is level. An orientation line, preferably the north direction, is drawn through the centre of the table (Fig. 7).

Orientated Coring Procedure.

1. *Orientation of Coring Device.*

After ascertaining that the pointer (*K*) in the core barrel and orientation marks (*L*) on the core barrel and the outer string are in line, the coring device is lowered to the bottom of the auger hole. For practical reasons, the orientation mark is then orientated to magnetic north by rotating to the right.

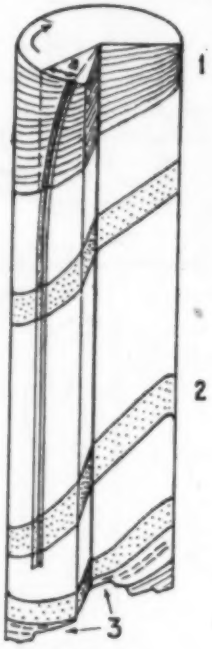


Fig. 8.

POSSIBLE DEFORMATIONS OF CORE CAUSED BY CORING AND EXTRACTION.
(All deformations are exaggerated.)

a. Deviation of orientating groove caused by inadequate swivel rotation indicated by arrow.

1. Upward edge drag caused by extraction of core from barrel.
2. Downward edge drag caused by punching of core.
3. Flattening at core base caused by vertical compression due to increased friction between core and core barrel at end stages of coring.

2. *Coring.*

About ten to fifteen strokes with the upper link of the drive rod, in general, suffice to secure a full-sized core. To prevent damage to the guide key and guide tube by over-driving, it is important to ensure that during the actual coring operation the outer string descends at the same time as the core barrel.

3. *Recovery of Core.*

It usually requires some effort to withdraw the core barrel from the core hole. Of course, rotation cannot be applied, as it might cause dis-orienta-

tion of the core or damage to the slotted guide tube. As a rule, two men can pull the coring device out of the formation, but occasionally the use of a lever is necessary. Care must be taken to avoid bending the outer string in such cases.

Before disconnecting the core barrel it is advisable to re-check the position of the orientation marks.

The extraction of the core from the core barrel is best undertaken with a core extractor of the type shown in Fig. 5. The swivel (Fig. 6) should be kept well greased to prevent distortion of the core and deviation of the orientating groove.

4. *Preparation of Core for Orientation and Determination of Strike and Dip.*

The geological compass is used in order to place the core so that the orientating groove faces magnetic north—*i.e.*, the direction which it faced when the core was cut.

Working on a carefully prepared bedding plane, the actual dip and strike of the subsurface rocks are then easily ascertained with the geological compass and dipmeter. Care must be taken, however, not to be misled by distortion of the core due to causes outlined above (see Fig. 8).

To assist in orientation of the core and in the reading of dip and strike, the use of a small table as shown in Fig. 7 is indispensable in the field. The level position of the table should be checked either by geological compass or by a non-magnetic " Universal " level attached to platform.

Practicability of Orientated Coring Based on Tests in the Field.

Based on extensive field work, it can be stated that almost 100 per cent. recovery of orientated cores can be expected from *soft formations* as are represented by Tertiary clays of Trinidad. In certain soft and loose sands, where ordinary hand-augering without circulation is very slow, if not impossible, the use of a hand-operated circulating pump and a spoon auger followed by auger-coring might yet prove more economical than pitting.

The fact that the use of orientated coring is restricted to relatively soft formations is not a serious drawback, since the dip and strike of hard formations can usually be adequately studied in surface exposures.

Accuracy of Orientation.

The accuracy with which dips and strikes can be measured for core samples depends largely on the proper indentification of bedding planes, through which a very much smaller section is cut than is the case in a test pit or exposure.

It is to be expected, therefore, that on the average the use of orientated cores gives results slightly inferior to that attained in large exposures or in pitting. A comparison between strike values obtained from cores and from test pits dug at the same spot in soft formations shows differences of less than 5 degrees, indicating that the accuracy of core orientation is within the accuracy of average field measurements for such rock types. Though slight deformations like edge-drag and torsion may affect certain parts of the core (see Fig. 8), the experienced field geologist is always able to recognize and select an unaffected bedding plane for measurement. In occasional doubtful cases check coring is advisable.

In a general sense orientated coring may even yield more reliable data than those obtained from exposures, since observations are made on rocks which are beyond the effective range of hill creep and landslips; characteristic features of soft formations in areas of high rainfall. It can be stated, therefore, that from the point of view of accuracy, this method of orientated coring has been proved in the field to be satisfactory.

General Remarks.

Efficiency.

A daily average of about twenty-five observations were made in the field. The investigation included the determination of strike and dips, a stratigraphical description of the core, sampling of the core for palæontological, petrographical, and geo-chemical analyses, and topographical sketching of the area under investigation. The above average compares very favourably with that attainable in test-pit investigations, which would be twenty pits per day under the same working conditions. Test pits, however, yield rather more information on account of the larger field of observation. On the other hand, coring offers better-preserved samples, containing foraminiferal assemblages, which are often absent at normal test-pit depths owing to the effect of weathering. A further advantage in favour of orientated coring over pitting is that cores may be taken at places where topography or land situation makes pitting impossible.

Time Distribution for Orientating, Coring and Notes.

Coring and Orientating Procedure and General Geological Notations.	Time (minutes).
1. Setting and orientation of coring device for holes of a maximum depth of 20 feet (in one string)	2
2. Coring, retraction of coring device from hole and extraction of core from core barrel	4
3. Preparation of core for orientation and determination of strike and dip	3–5
4. Geological description of core	1–5
5. Sampling for various tests	2–3
6. Topographical sketching	1–2

Total time spent as per observation is 13–21 minutes.

The preceding time analysis, though based entirely on the author's experience during the initial stage of orientated coring, would probably represent a fair average on which to base the utility of the device. No doubt, the orientated coring device and working methods will still be improved. For the present, it can be stated that results are obtained more rapidly and more conveniently than by pitting, a fact which tends to improve the quality of observation, especially in tropical climate.

Costs.

A comparison between expenses incurred in orientated coring and pitting based on 17 feet of average coring and 10 feet pitting depth, is, under the present local contract prices approximately 1 : 3 in favour of the coring method. At the same time, price parity between a 10-foot test pit and orientated coring would be reached at a coring depth of about 29 feet.

Labour.

Auger-coring from depths not exceeding 25 feet is usually done under contract. Two auger-men can easily drill twelve to fifteen holes of 15 feet

depth as a daily average in clay and shale formations. This provides the geologist with an amount of information which could only be obtained from an equal number of test pits of 8-foot depths dug by twelve to fifteen test-pit diggers. With a labour shortage such as is being experienced in Trinidad at present, this aspect is important.

Furthermore, under competitive conditions, the value of orientated coring is such as to allow a slight increase in the contract price of augering without increasing exploration costs and thereby speeding up operations.

Advantages of Orientated Coring Versus Test Pits.

1. A considerable increase in speed and ease of geological field investigation. The only disadvantage is slight inferiority of accuracy of orientation due to restricted field of observation.
2. Recovery of uncontaminated material.
3. Recovery of unweathered material with well-preserved foraminiferal assemblages.
4. Greater freedom in lay-out for field examination made possible by coring at depths below the effective range of hill creeps and landslips. This makes possible an even net of field observation which is of considerable importance.
5. Minimization of damage to cultivations, and no possibility of claims arising out of injury to personnel or stock, such as may occur with pits which are left uncovered or incompletely filled.
6. Reduced difficulty in obtaining consent from landowners to lay-out lines in their properties. Even when such consent is withheld, coring lines may always be established along public roads and the boundary lines of areas under investigation.
7. Lower cost of orientated coring as compared with investigation by pitting.
8. Considerable saving in labour.

Acknowledgments.

The author is indebted to Mr. H. C. H. Thomas for many technical suggestions, to Mr. P. M. Greer for construction details, to Mr. C. F. Lamont for drafting the figures and to Dr. H. G. Kugler for assistance in the preparation of the paper. Special thanks are due to Trinidad Leaseholds, Ltd., for the permission to publish this paper.

Bibliography.

[1] Wall, G. P., and Sawkins, J. G., "Report on the Geology of Trinidad." Memoirs of the Geol. Survey, London, 1860.

[2] Cunningham Craig, E. H., "Trinidad Oilfields. General Report by the Government Geologist on the Central and Northern Anticline (Western Districts)." Council Paper No. 60 of 1907. Port-of-Spain, Trinidad. April 1907.

[3] Illing, V. C., "Geology of the Naparima Region of Trinidad," *Quart. Journal Geol. Soc. London*, 1928, Vol. 84.

[4] Jenkins, O. P., "Test-pit Exploration in the Coastal Plain of Sumatra," *Bull. Amer. Assn. of Petrol. Geol.*, 1930, **14**, 1439–1444.

[5] Scott, E. C., "Augering and Core-drilling for Geological Purposes in Trinidad," *J. Inst. Petrol.*, 1939, **25** (190), 501–508.

THE INSTITUTE OF PETROLEUM.

AN INAUGURAL MEETING to mark the opening of the Institute's new premises at 26, Portland Place, W.1, took place on 17th February, 1944. The President, PROFESSOR F. H. GARNER, was in the Chair. Tributes were paid to the memory of the late President, Mr. C. Dalley, by LT.-COL. S. J. M. AULD and DR. A. E. DUNSTAN, and subsequently two films, "Oil from the Earth" and "Protection of Fruit," were shown. Following tea, many members inspected the new offices.

THE PRESIDENT: Since the date of our last meeting, the Institute and its members have suffered a grievous loss in the death of the President, Mr. Christopher Dalley. As you know, Mr. Dalley was trained as an electrical engineer and took a very keen interest in all of the many applications of electricity to the oil industry, and in particular in connection with oilfield operations, some of which he described only as recently as a month ago. He was Chairman of the Finance Committee of the Institute of Petroleum for many years, and it is largely due to his action that we are present in this building today. But I think most of us will remember Mr. Dalley particularly for his personal qualities, and many of us will have pleasant memories of the inimitable way in which he conducted the meetings of the Oil Industries Club.

I will now call on Lt.-Col. Auld and Dr. Dunstan, both of whom have been closely associated with Mr. Dalley throughout many past years, to pay tributes to him.

LT.-COL. S. J. M. AULD, O.B.E., M.C.: Christopher Dalley's death has robbed the Institute of a worthy and devoted President and parted its members from a dear friend. Yet I feel, and I am sure you will feel with me, that this occasion of the inauguration of our new home is a fitting opportunity for us to get together and speak of him openly and to praise him, because Dalley's spirit was one which never could cast a gloom over any proceedings, anywhere or at any time. Moreover, this successful culmination of our house-hunting, which has resulted in achieving an independent home of our own, was a matter which was close to Dalley's heart and one in which he naturally took a great pride, he being President at the time during which it was brought to fruition.

I, on my part, am proud to have the opportunity of talking about Dalley, because he was a personal friend as well as a professional colleague. I worked with Dalley off and on—and played with him—for the better part of a quarter of a century, and it was always a gift to me to feel he was there in the background of things. He had that wonderful attribute of giving strength to others, so that his very existence was a sort of benediction, and I think it might truly be said of him that ". . . his life, his spirit and his work were one."

Certainly I never attempted to disentangle any of these three things about him.

Dalley, as I think we all know, was a man of original and pioneering trend of mind, but he never let that originality of thought run riot with him. He was too much of the well-trained engineer, of the well-trained

man of science, to let that happen. He always had his feet solidly implanted on the double truths of experience and of knowledge, and the result was that his engineering, even when it took in its application some of the most novel turns, was always substantially right and, in practice, a complete success.

Dalley came to the young Petroleum Industry in this country in 1915 with a fund of knowledge which he had acquired of industry in general and with a natural bias from his antecedents, of which the President has spoken, towards the application of electricity to industry and to the oil industry in particular. He almost immediately joined forces and established a quite remarkable technical partnership with that virile and vivid personality, Dr. Dunstan, which resulted, under the Chairmanship of Greenway—later Sir Charles Greenway and then Lord Greenway, and a Past-President of this Institute—in the magnificent technical development of the growing Anglo-Persian Oil Co. and which led to the outstanding successes it achieved. There was a whole procession of schemes for production. New fields, pumping-stations, pipe-lines and refineries followed each other rapidly, all dealing with an entirely new type of crude for which there was no past history or experience. These problems were all met in their stride, and at the back of it all was Dalley's ability to meet the new problems, which was always with that extra bit of knowledge and of thought beyond the then existing best. He himself, I think, was always proudest of his successful harnessing of the turbine direct coupled to the high-lift high-speed centrifugal pump for pipe-line work, but my personal recollection of him in that respect at that time was rather of the meticulous care which he took to ensure the very highest possible efficiency in the use of heat and heat exchange. At that time it was very largely a question of new types of boilers and of boiler efficiency, of scientific lagging of pipework and the use of exhaust steam—those things which Dalley had a humorous way of describing as tracking down the elusive B.Th.U's.

Dalley was a fine " picker " of men, and one of his greatest attributes, I think, was his successful team work. What is more, to the men whom he picked he was always an unchanging friend. They, in their turn, were invariably devoted to him. Past friends of ours, like Holmes and H. Y. V. Jackson, had an affection inspired in them which it is both difficult to describe or to exaggerate, and had to be known to be understood. The same thing applied when Dalley gave up his more purely engineering work and joined R. R. Tweed in the dual control of the administration side of the big companies with which they were concerned. The reason for this attribute of Dalley's was, of course, that he was essentially a big man, and he was essentially a good man. He was generous in his every thought and his every act was a gift. For all his recognized and outstanding success, amongst which he was greatly proud of his position as President of this Institute, I like to think of that side of him which will live in our hearts and of which Wordsworth wrote :

> That best portion of a good man's life—
> His little nameless unremembered acts
> Of kindness and of love.

DR. A. E. DUNSTAN : I think you will agree with me that there is no more difficult task set a man than to pay an appropriate tribute to a friend

of very long standing. I suppose I knew Dalley longer than and better than most people in this room. I first met him just on thirty years ago, and in trying to pay this tribute to his memory perhaps I am apt to forget the man himself and see him through a mist of very affectionate reminiscences.

Like Col. Auld, I met him in the early part of 1915, just when the petroleum industry was beginning to feel its feet, and I joined the old Anglo-Persian Oil Co. at a time when Dalley and Andrew Campbell and myself formed such a small nucleus about which arose the great technical staff which subsequently made the Company's name so famous. It was my good fortune at that time to be at the chemical end, Andrew Campbell, with a solid background based on long experience with the Scottish shale industry and with the Burmah Oil Co., was the refining expert of the Company, but Dalley brought in, if I may say so, a sort of new life. Dalley came in with his expert knowledge of electrical engineering at a time when that had hardly begun to find a place in the industry. Dalley made electrical engineering a very real and very important factor in the winning and refining and transport of petroleum.

It is very curious to look back on those days nearly thirty years ago, when mineral oil was the raw material for just one or two products, and to realize how these pioneers builded better than they thought. They led the way for an ever-increasing and better technical staff, and they were even able to show the way to a more enlightened policy.

But there it was. All three of us—Dalley, Campbell and myself—found our intellectual home in this Institute. All three of us served on its Council for many years. Two of us attained to the honour of its Presidency.

Looking back on those early days, how can one fail to regard with the deepest sympathy and affection the youthful energy and enthusiasm which Dalley put into all those things that appealed to him?

This, of course, is not the occasion to deal with Dalley's academic and professional attainments. They will be dealt with in a forthcoming issue of the *Journal*. But apart from all that, do not we realize that in Dalley we had one of those rare people who are by Providence endowed with the possibilities and potentialities of leadership? Dalley would have been more than honoured, more than delighted, to be here today. These new offices of ours were very much in his mind almost up to the day of his death. He was delighted to find that at long last the Institute had a proper and a delightful home. But once again one feels inclined to stress the personal qualities of the man, apart from his scientific and technical achievements. One feels inclined to stress particularly the man that we knew; the Dalley that we loved. He was primarily, as Priestley would have defined him, a Good Companion, and that is a pretty good testimonial to any man. Like that famous character, Abou den Adam, he loved his fellow men. His chief quality, I think, was that. He was the centre, the nucleus, of good fellowship. He was never lonely because he had the habit and the knack of surrounding himself with kindred spirits. He was as approachable to the latest-joined junior as he was to the oldest senior. He loved to shake off the shackles and trammels of his official position, and he loved to mix freely with his friends, to their advantage and to his. It is a very old tag, *nisi bonum de mortuis*.

MANSON HOUSE.

[facing page 92.

ENTRANCE TO OFFICES.

CORNER OF

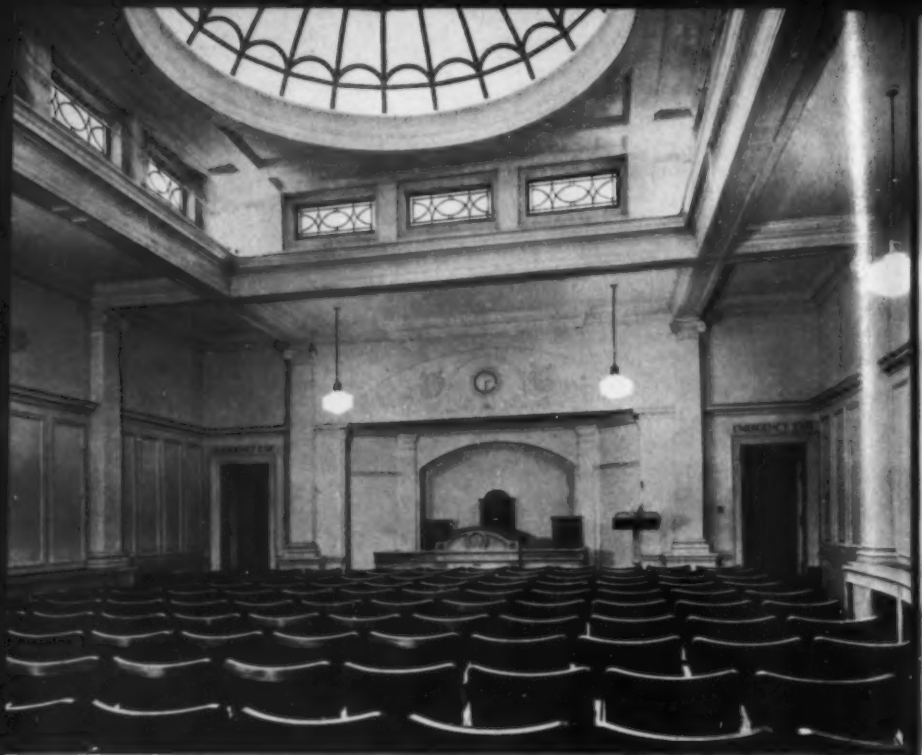
SECRETARY'S OFFICE

GENERAL OFFICE

COUNCIL ROOM.

OF

OFFICE



LECTURE HALL OF THE ROYAL SOCIETY

OF TROPICAL MEDICINE AND HYGIENE

AVAILABLE FOR USE BY THE INSTITUTE.

How particularly true is that of Dalley. How could anybody fail to say "Here is a good man, we can say nothing but good of him; here is a man of whom we speak with the greatest respect and the greatest affection?" We say to Dalley

Ave atque vale.

THE HON. SECRETARY said that after the very eloquent tributes that had been paid to the late President, it devolved upon him officially to announce the arrangements which had been made for the continuity of the work of the Institute. The Bye-laws of the Institute provided that the Council had in its power the election of a President to fill any casual vacancy which might occur. Therefore, they had unanimously selected Prof. Frederic Horace Garner for this very important position. Knowing as well as the members did the brilliant attainments of Prof. Garner, they would, he was sure, welcome the choice which had been made by the Council. Prof. Garner had for many years been a very keen and ardent worker for the affairs of the Institute in general, and if there was one effort to which special attention should be directed, it was Prof. Garner's work in connection with the compilation and production of "Standard Methods for Testing Petroleum," which were so widely used throughout the petroleum industry. The Council had every confidence that the members would give their full support to Prof. Garner in the arduous duties which he now undertook, and thereby enable the Institute to go from strength to strength.

OBITUARY.

JAMES McCONNELL SANDERS.

JAMES McCONNELL SANDERS died at Pinner on the 4th February, in his 70th year.

Educated at King Edward VI School, Berkhamsted, and at Eastbourne College, he gained a "Keeling" Scholarship to University College, Aberystwith, which, however, he had to relinquish at the end of a year owing to ill health. He returned to his school as assistant science master for two years, and then went to the Dartford Works of Messrs. Burroughs and Welcome & Co., where he was engaged in research on photochemicals and alkaloidal and fine chemicals. In 1902 he went to Mexico, and in 1903 secured the appointment of Chief Chemist to the Mexican Government Central Customs Department, a position which he held for twelve years, together with that of Agregada in charge of the Department of Applied Chemistry and Technological Research. In 1908 he was appointed Professor of Applied Chemistry by the Department of Public Instruction, and in 1913 was accorded the title of Professor of Applied Chemistry in the University of Mexico.

He left the service of the Mexican Government in 1915 to become Chief Chemist of the Anglo-Mexican Petroleum Company, and later returned to England, where, from 1923 to 1938, he was Chief Chemist and Technical Adviser to the Mexican Eagle Oil Company, and later a research chemist with the Asiatic Petroleum Company.

Mr. McConnell Sanders had a deep and abiding interest in the microscope, and his great ambition was to probe into the origin and history of petroleum. He showed that the microscope could provide valuable information regarding the source deposits and reservoir formations from which any given oils were derived, and much of his work was described in a paper entitled "The Microscopical Examination of Crude Petroleum," which was read before the Institute in 1937.

Mr. McConnell Sanders joined the Institute of Petroleum in 1923, was elected a member of Council in 1928, and a Vice-President in 1933. Many past and present members of Council will wish to remember him as a very active colleague who rendered invaluable service to many Committees of which he was a member and whose wise counsel will be sadly missed. Far more will be missed a kindly and genial friend.